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ABSTRACT

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Information Series No. 176

TEN MATHEMATICS PROJECTS AND CAREER EDUCATION INFUSION

written by

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FOREWORD

The Educational Resources Information Center on Adult, Career, and Vocational Education (ERIC/CE) is one of sixteen clearinghouses in a nationwide information system that is funded by the National Institute of Education. One of the functions of the Clearinghouse is to interpret the literature that is entered in the ERIC data base. This paper should be of particular interest to classroom teachers of mathematics, from kindergarten to grade twelve.

The profession is indebted to Harold D. Taylor for his effort in the preparation of this paper. Recognition also is due James Gates, National Council of Teachers of Mathematics; Thomas Denmark, Florida State University; and John Peterson, the National Center for Research in Vocational Education, for their critical review of the manuscript prior to its final revision and publication. Robert D. Bhaerman, Assistant Director for Career Education at the ERIC Clearinghouse on Adult, Career, and Vocational Education, coordinated the publication's development. Cathy Thompson assisted in the editing of the manuscript and Millie Dunning typed the final draft.

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ABSTRACT

Ten projects which used mathematics as a major element to infuse career education into the regular school curriculum are presented in this review. The projects generally include programs for grades K-12. The report analyzes the ten projects from the standpoint of whether or not mathematics was involved as a subject area and, if so, to what extent. Such relevant data as the grade levels involved, the types of student population, the types of student population, the types of school districts, the cost of implementation, and the level of success are reported. The projects by title and location are as follows: (1) Career Development Program, Akron (Ohio) Public Schools; (2) Developmental Career Guidance Project, Pima County, Arizona; (3) Fostering a Team Approach to Career Education, Prince George's County (Maryland) Public Schools; (4) Project CAP, Boston Mountains (Greenland, Arkansas) Educational Cooperative; (5) Project CDCC, Coloma (Michigan) Community School District; (6) Project CERES, Ceres (California) Unified School District; (7) Project EPIC, Ft. Lauderdale, Florida; (8) Project EPIC, Jefferson County (Kentucky) Public Schools; (9) Project Equality, Highline Public Schools (Seattle, Washington); (10) Project MATCH, Ontario-Montclair (California) School District. (CT)

DESC::*Career Education; Elementary Secondary Education; *Mathematics; Program Costs; *Program Evaluation; *Fused Curriculum

IDEN::Career Development Program; Developmental Career Guidance Project; Fostering Team Approach Career Education; Project CAP; Project CDCC; Project CERES; Project EPIC; Project Equality; Project MATCH

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BACKGROUND

The term "career education" was used initially in 1971 by Sidney P. Marland, Jr., former Commissioner of Education in the U. S. Office of Education (USOE). However, he refused to provide a single USOE definition of the term. Instead he called for its meaning to be forged by local, state, and national actions. As a result, career education has been defined in a variety of ways by a variety of school districts.

Career education has enjoyed significant implementation in the public schools since 1971. According to Hoyt (1976):

> At least ten major national associations have endorsed career education. Career education programs have been initiated in almost one-third of the nation's 17,000 school districts. Career education has been endorsed by both of the USOE Commissioners of Education -- Dr. John O. Ottina and Dr. Terrel H. Bell -- who have followed Dr. Marland in occupying that position. When P.L. 93-380 was passed and signed into law, in August 1974, career education became, for the first time in history, a mandate of the Congress of the United States. (p.1)

The two generally accepted methods for implementing career education into a curriculum are "infusion" and "add-on." Infusion is "used to refer to any effort of a teacher, school, or school system to provide specific career-related instruction as part of an existing subject curriculum" (Popper and McClain, 1978, p. 6). The concept of infusion

is the opposite of another course added on to an already structured curriculum.

There is general agreement that the introduction of career education should be made early in the experience of a child and continued throughout grades K-12. Methods of implementation have not been uniform for a variety of reasons, including differences in educational philosophy, available finances, individual district needs, and staffing capabilities.

Different subject areas have been utilized to bring career education to the students. There are those who maintain that one particular subject should be involved. Some favor English and the language arts as that subject. Others argue that social studies is the best vehicle. On the whole, however, it appears that consensus rests with the idea that it is better to make use of several subject areas in the implementation of career education, thereby taking advantage of the potential each has to offer. It is the intent of this paper to report, albeit briefly, on the extent to which mathematics has been utilized in ten significant career education projects.

One of the first steps in researching this area was determining a method of identifying some key districts that have used mathematics to implement career education to any great extent. This was not an easy task since no single agency has the facilities to disseminate all the existing information about schools and their involvement in career education. This problem prompted the writer to limit the investigation to projects that were either state or federally funded. Such projects were readily identified through the ERIC Clearinghouse on Adult, Career, and Vocational Education at The Ohio State University, the San Mateo Education Resources Center, and the Far West Laboratory for Educational Research and Development.

A large number of projects were identified. Contacts were made with a number of project directors and administrators. This process proved less helpful than was desired, since many of the projects identified were either not in operation any longer or were not evaluated. Another limitation, therefore, was necessary. Only those projects that had been evaluated formally and only those where the personnel involved were still available were considered.

THE TEN PROJECTS

The resources provided by the American Institutes of Research (AIR) of Palo Alto, California also proved to be extremely valuable. Under a grant from the Office of Career Education, AIR (in June, 1978) completed a series of detailed reports on exemplary career education programs.

The overall goal of the AIR project was to examine the effectiveness of career education by identifying exemplary programs. Specifically, the objectives of AIR were to gather and analyze reports of career education evaluations from K to 12 which were completed since June, 1974, identify specific activities which were objectively evaluated and had shown evidence of effectiveness, prepare documentation for dissemination on the activities found to be effective, and prepare a handbook for local career educators for evaluating their activities (Hamilton and Mitchell, 1978).

In order to meet these objectives, nominations of evaluated activities were solicited from practitioners in the field. AIR received 394 nominations from numerous sources, including state career education coordinators, directors of vocational education, state and district pupil personnel service personnel, and directors of research coordinating units. Nominations also were solicited from national laboratories and centers, federal funding agencies, and third party evaluators. From the nearly four hundred nominations, evaluation reports were solicited from project directors. These reports were screened through a set of criteria relating to quality and effectiveness. Ten of the projects judged to have been the most effective on the basis of the evaluation reports were selected. Visits were made then by AIR staff to the sites in order to validate evaluation data and gain additional data where necessary, gather more detailed information about project management and operation, and learn about any unanticipated outcomes of the activities.

Ultimately, seven of the ten projects identified in this procedure were approved by HEW's Joint Dissemination and Review Panel which evaluates projects for national dissemination through the National Diffusion Network and the Office of Career Education.

The ten studies identified by the American Institutes of Research have become the basis for this report. The projects were well distributed geographically. They also were diverse with respect to the student populations served, grade levels, and size of school district involved. Rural, urban, and suburban districts were represented. In short, the identification process used by AIR resulted in a highly diversified list of projects.

This report analyzed the ten projects from the standpoint of whether or not mathematics was involved as a subject area and, if so, to what extent. It also reported on such relevant data as the grade levels involved, the types of student population, the types of school districts, the cost of implementation, and the level of success.

The projects by title and location were:

CAREER DEVELOPMENT PROGRAM
Akron Public Schools
Akron, Ohio

DEVELOPMENTAL CAREER GUIDANCE PROJECT
Pima County, Arizona

FOSTERING A TEAM APPROACH TO CAREER EDUCATION
Prince George's County Public Schools
Upper Marlboro, Maryland

PROJECT CAP
Boston Mountains Educational Cooperative
Greenland, Arkansas

PROJECT CDCC
Coloma Community School District
Coloma, Michigan

PROJECT CERES
Ceres Unified School District
Ceres, California

PROJECT EPIC
EPIC, Inc.
Fort Lauderdale, Florida

PROJECT EPIC
Jefferson County Public Schools
Louisville, Kentucky

PROJECT EQUALITY
Highline Public Schools
Seattle, Washington

PROJECT MATCH
Ontario-Montclair School District
Ontario, California

CAREER DEVELOPMENT PROGRAM
(Akron, Ohio)

This program involved grade levels K-10 and was funded by federal, state, and local money. The project was actively developed during the five year period, 1971-1975. Funding limitations did not allow for development in grades eleven and twelve. According to a report of the American Institutes of Research (McBain, 1978), the Career Development Program consisted of a pattern of career related activities integrated into all aspects of Akron's K-10 curriculum, increasing in detail and sophistication as students reached higher grade levels. The critical assumptions of the program were these:

- Career education activities must begin early because the fundamentals of children's career development begin early.

- Career education must be "infused" into the whole curriculum instead of being "added on," changing the curriculum's focus more than its content (because) one of the purposes of career education is to demonstrate the relevance of all school subjects to the world of work. (p. 2)

All grade levels (K-10) used mathematics, along with other subject matter areas, to infuse career education into the curriculum. Among other things it was reported that the relevance of mathematics to all fifteen career clusters identified by the Office of Career Education was emphasized.

In 1975-1976 this program was fully implemented in eleven elementary schools, three junior high schools and two senior high schools serving a total student population of 13,600. This required a sophisticated staffing arrangement,

including a district program director, several career education coordinators, most of the district's classroom teachers, and liaison persons from business, industry, labor, and community service.

The director of career education programs in Akron noted that Akron is a city of approximately 275,000 persons. Primary employment in the area is manufacturing, with professional services and trade occupations second and third, respectively. The district enrollment is approximately 50,000 students served by nine senior high schools, ten junior high schools, and forty-seven elementary schools. About sixty percent of the students were members of minority groups. In grade ten, about thirty percent pursued an academic program.

In 1975-1976 it cost approximately $20 per student at the K-6 level, $25 per student at the 7-8 grade level, and $30 per student at the 9-10 grade level to operate the program.

The final report of the project indicated that in the K-6 curriculum there was a heavy dependence on in-class activities; about six to eight hours each week were devoted to career education. An example used for an activity for third graders in one elementary school was a project to make what they termed "warm fuzzies." Students used yarn, glass eyes, pipe-cleaners,and glue to make these in an assembly-line setting. Motivation for this activity was a story in which "warm fuzzies" were exchanged as a way of saying, "I like you." Before beginning production, some preliminary activities included field trips and speakers. Assembly-line production and methods of dividing labor were observed by the students. An attorney discussed forming and operating a corporation, and a banker discussed different kinds of accounts.

Subsequent to the preliminary activities, a corporation was formed, shares were sold, and a board of directors was elected. After decisions were made regarding the labor force needed, students applied and were interviewed for jobs. At stockholders' meetings, decisions were made regarding purchase of capital goods and raw materials (scissors, wire cutters, storage containers, art supplies, yarn, pipe cleaners, glue, and glass eyes). The number of assembly lines needed were determined and safety rules

written. Prices for different sizes were determined after the first production run.

Advertising and promotion activities were devised. These included three kinds of sales: direct marketing, taking orders from different sources, and selling through agents such as church bazaars. Money from these sales provided stockholders with dividends which returned their original investment -- as well as money for donations to a hospital fund and to the school.

According to McBain and Topougis (1978),

> this example illustrates an activity which taught the students a great deal about the business world, but at the same time stressed basic academic skills in mathematics and communications, as well as problem solving, decision-making, and group participation skills. (p. 9)

In a report submitted to the Joint Dissemination and Review Panel, McBain (1978) stated:

> The large number of students and their diversity on important factors offer evidence that the program is widely effective for K-10 students. The analyses of results by subgroup further support this conclusion.
>
> In sum, the evaluation of the Akron career education program in 1975-1976 reveals differences in student learning which are consistently higher for program students across many developmental areas and grade levels. The consistency of results and the importance of the goal areas offer strong support that the Akron career education program is an effective and important educational effort. (p. 10)

DEVELOPMENTAL CAREER GUIDANCE
PROJECT (Pima County, Arizona)

This project was almost totally funded by the Arizona State Department of Education with activities involving grade levels K-12. It was designed mainly to develop knowledge and skills in the areas of self-awareness, self-esteem, the world of work, and decision-making. According to McBain and Jung (1978), the goals of the Pima County Developmental Career Guidance Project were defined by the Arizona Career Education Matrix, developed and approved by the Arizona State Department of Education with the help of the local district and school staffs.

The seven categories identified by McBain and McKay (1978) in the report of the projects were: self-awareness, career awareness, decision-making, employability skills, educational awareness, economic awareness, and appreciation and attitudes. According to the report, some of these areas were stressed more at one level than at others. For example, self-awareness, self-esteem, and decision-making were considered paramount at the K-6 level, while at the 7-9 level the occupational clusters were studied in great detail. At the 10-12 level, direct contact with career areas was provided.

In the process of reaching the stated goals, it was evident that mathematics was an important vehicle. The project director stated that, "Teaching addition may be done on 'restaurant checks' in a simulated coffee shop instead of on blank paper" (McBain and McKay, 1978).

The project encompassed eleven school districts in Pima County, Arizona, which together have 104 elementary schools, thirty-four junior high schools, and seventeen high schools, serving 93,000 students. According to an American Institutes of Research report (McBain and Jung, 1978), the project was coordinated and facilitated by the Pima County Developmental Career Guidance Project. The staff consisted of four teams of persons working out of separate offices serving different county areas. The central office in Tucson was run by the project director and staffed by guidance specialists and support staff. The three area offices, located in small districts outside of Tucson, were each headed by an assistant director and staffed by guidance specialists plus a small support staff.

Pima County is a very diversified area containing the city of Tucson and large areas of farm land and reservation land. Its population is about twenty percent minorities, including Mexican-Americans and native Americans. In 1974-1975, the per-pupil cost of operating the program was about $7.00.

McBain and Jung (1978) reported to the JDRP:

> It can be confidently stated that this program is effective with a student population made up of approximately eighty percent white students and twenty percent Mexican-American, American Indian, and other minority students. The positive evidence of effectiveness presented for 1974-1975, borne out by similar results found in later years but not reported here, supports the claim that this program would give excellent results when replicated with a similar group of students.(p. 10)

FOSTERING A TEAM APPROACH
TO CAREER EDUCATION
(Upper Marlboro, Maryland)

This career education program, involving the Prince George's County Public schools, was developed in 1974-1975. It was funded by the federal vocational education program and was administered by the Maryland State Department of Education. The intent of the program was to infuse the career education concept into the junior high school curriculum primarily by way of the English, social studies, mathematics, and vocational educational programs. As reported by Lipe (1978a), the goal of the program was to enhance the career development of students with a focus on the following outcomes: knowledge of occupational characteristics; knowledge of what is required to prepare for occupations; experience in exploring occupations; knowledge about how to plan a high school program relative to a career as well as when and how to make career educational decisions; and involvement in career planning. Inservice training sessions were planned and carried out at the county level; the implementation of the program was carried out by classroom teachers, and a full-time and two part-time county

coordinators of prevocational education. Prince George's County borders Washington, D.C. The county is highly dependent upon a working population whose jobs are largely related to the federal government. The median income is slightly above the national median with the population seventy-five percent white, twenty-three percent black and two percent other minorities (Lipe, 1978a; Lipe and Gushee, 1978).

The county serves approximately 150,000 students in grades K-12 and has an enrollment of about 35,000 students in forty-one junior high schools. School sizes ranged from 600 to 1,200 students. The project director indicated that over the period 1975-1976, the cost of implementation was in the neighborhood of $2.77 per student, per year. There was no indication why the cost reported was so low in comparison with other projects reported.

Lipe (1978a), in his submission to the Joint Dissemination and Review Panel, wrote:

> Career development of ninth grade students can be enhanced indirectly through a staff development activity involving social studies teachers, vocational teachers, and counselors working together in a team approach to career education. The approach was cost efficient in that the outcomes were achieved by one full-time and two part-time county-level staff persons who conducted the staff development activity for *existing* local school personnel. Results appear to be educationally meaningful and generalizable to other school districts where career education is accepted as a high priority need.(p. 10)

PROJECT CAP
(Greenland, Arkansas)

This project, a product of the Boston Mountains Educational Cooperative, went through its developmental stages during the years 1974-1977. The goal of the program was to cause students, grades 1-8, to be significantly more aware of careers than a group of similar students not involved in the project.

Hamilton and Kaplan (1978) stated in their report to the Joint Dissemination and Review Panel that:

> The Boston Mountains Educational Cooperative is a consortium of eight school districts in a rural, mountainous area of northwest Arkansas....Project CAP serves students from six of the consortium districts, five of which are located in Washington County and one of which is located in Madison County. The estimated population in the geographic area served is 16,000 persons with a school enrollment of 5,100. Ninety percent of the population is from rural farm families; the remaining ten percent are considered rural non-farm families. Fifteen percent of all families in Washington County and 33.1 percent in Madison County are classified as having an income less than poverty level. The school population is predominantly Caucasian. (p. 1)

In the implementation of PROJECT CAP in Greenland, Arkansas, numerous methods were used to infuse career education into the regular curriculum: learning centers, resource people, field trips, films, "hands-on" experiences, role play, games,and learning activity packages. Among these, the project staff chose learning activity packages as the primary means of infusion.

The final report by Hamilton and Leffler (1978) noted the following:

> Project CAP learning packets were developed to show students that school subjects are important and related to the world of work by pairing a specific academic skill with a selected occupation. As the teachers blended this career information into the various subject areas, they added a measure of relevance and practicality to the instructional process. One of the key expectations stressed by Project CAP was for every teacher to emphasize the contribution that subject matter can make to a successful career.

> It was assumed that Project CAP learning packets would assist students in becoming aware that a subject matter area with its associated skills has actual value for their present and future achievement of goals. For example, in the study of fractions in the upper elementary grades, the occupation of chef is discussed. A chef's job involves the measuring of ingredients, such as one-half teaspoon or one-fourth cup. Students can see the importance of learning fractions, especially for this worker. In another example, the skill of telling time on a clock is linked to the occupation of cosmetologist. (p. 7)

Project CAP curriculum included a scope and sequence chart which indicated concepts to be taught across the fifteen Office of Career Education clusters. The materials were packaged in kits to be infused into the regular curriculum within a ten to fifteen minute period for each kit. The total program consisted of thirty-two packets at each grade level (Hamilton and Leffler, 1978). It was not clear, however, exactly which academic subject areas were involved in the implementation of the program. Although the extent could not be ascertained, it was evident that mathematics was one of the areas utilized.

The project staff consisted of four professional persons: a director, two curriculum coordinators, and a deputy evaluator. The director, the coordinators, and the evaluator made routine visits to schools to meet with teachers and administrators. It was during these visits that the in-service training of classroom staff took place. Parents and community were involved as classroom resources for discussions and presentations.

Over the entire development period, the average cost per pupil to implement the program was $22.56 per year. This cost, however, did not include office space for the coordinators and the director since the school districts provided this space to the project at no cost.

Mean post-test differences between treatment and control schools by grade level were analyzed using the *t*-test on the three test instruments administered: the Career

Awareness Test, the Career Knowledge Test and the Orientation to Career Concepts/Worker Activities Scale. The analysis results indicated that treatment schools out-performed the control schools in all cases, at all grade levels. Hamilton and Kaplan (1978) reported to the JDRP that:

> The evaluation plan used, the data collected and the resulting analyses provide reasonably convincing evidence that Project CAP produced educationally significant results. The treatment and control groups were equivalent on such variables as school population, school staff per student, district expenditure per ADA (Average Daily Attendance), average assessed valuation, geographic location, socio-economic factors, curriculum and exposure to information from outside the school....The large sample that included grades 1-8 and the very high level of statistical significance attained across all grades indicate that the Project CAP goal of significantly increasing students' awareness of careers was achieved. (pp. 7-8)

PROJECT CAREER DEVELOPMENT
CENTERED CURRICULUM
(Coloma, Michigan)

This project was developed from 1972 to 1976 with the curriculum designed to provide career development instruction to rural elementary level students. The goal of the project was to enhance career development by infusing specially developed units into the existing curriculum. Objectives for students were as follows: to demonstrate an increased awareness of life roles, to formulate realistic concepts, and to develop and use decision-making skills.

Kaplan (1978a), in her submission to the Joint Dissemination and Review Panel, indicated that Coloma is a rural, southwestern Michigan community, with a population of approximately 12,000 persons. This population is comprised mainly

of middle-class families who are primarily employed by business and industry related to agriculture. Kaplan also indicated that the school district had a population that was ninety-six percent white, with the remainder composed of native Americans, blacks, and Asian Americans.

The three elementary school districts involved in the project had a total population of 1,600 students. The average class size was twenty-four, and the average per-pupil expenditure for regular school programs was $1,224. The project was staffed with a director, an assistant director, and a project coordinator. An outside evaluator was used on a contract basis (Kaplan and Downey, 1978).

After a developmental period which included pilot testing in selected classrooms, refinements of the career education units were made. The resulting products comprised a comprehensive career development program for K-6 students. The curriculum developed was made up of twenty-seven units, four for each of the grades K-5 and three for grade six. One of the four major areas utilized to carry career development to the students was mathematics.

The total cost of the program from 1972 to 1976 was $440,395. During this period the project served 5,800 students, with an annual cost per pupil of approximately $76.00.

The project's format contained career education teaching units, with each unit composed of four sections. The first section was used to identify the unit's elements, themes, goals, and objectives. In the second section the teaching strategies were described and organized into subtopics, with suggested resources to be used while teaching each one. The third section contained tips to aid teachers in implementing specific learning activities. The final section contained student activity sheets.

These units utilized a variety of teaching techniques other than activity sheets, for example, classroom discussion and audiovisual materials. Techniques of particular importance were role models, role playing/simulation, and field trips. The following were cited as specific examples of activities at different grade levels:

> At the kindergarten level, teachers bring resource people representing school workers and community helpers into their classrooms. First graders simulate a food store, in which students can purchase items. In grade two, students role play in conjunction with a bakery unit. Third graders simulate a restaurant....The career education activities are completely integrated into the existing subject matter. For example, the restaurant industry unit includes the following subject areas and activities: health (categorizing food into the four basic food groups), language arts (spelling, capitalization, and grammar), and math (adding, subtracting, dividing, and using graphs). (Kaplan and Downey, 1978, pp. 8, 10)

Evaluation of the project was achieved by comparing Coloma to two neighboring communities which were used as control sites. Comparability of the academic achievement at the three sites was determined through the Michigan Educational Assessment Program. This yearly statewide testing program included testing mathematics achievement at the fourth grade level. Students in both experimental and control groups were pre-tested and post-tested regarding the objectives of the units and overall program. Substantial differences in post-test performance between experimental and control groups were found in favor of the experimental groups (Kaplan, 1978a). In order to substantiate the impression given by these results, AIR calculated Chi-squares between control and experimental groups for each objective of the program. Separate Chi-squares were computed between pre-test and post-test scores on each objective. These results were summarized by Kaplan (1978a):

> Of the eighty-three objectives with pre- and post-test data available, thirty-nine have non-significant post-test difference in favor of the experimental group. Thirty objectives have non-significant differences on both the pre- and post-test; however, twenty-two of these thirty objectives show larger increases in the Centerville students' achievement than in that of the Mendon

> students. In other words, change in performance was in the right direction, although it was not enough to result in a significant difference at the time of post-testing. (p. 6)

It is important to point out here that on the statewide assessment test in mathematics the Coloma students in grade four had a percentage increase three times that of the statewide increase; the seventh graders had an increase in mathematics greater than the state as a whole.

The American Institutes of Research report to the Joint Dissemination and Review Panel indicated that there was a strong indication that the project could be generalized to other similar communities and school populations (Kaplan, 1978a).

CALIFORNIA CAREER EDUCATION
PROGRAM: PROJECT CERES
(Ceres, California)

This project was developed during the period 1972-1976 at a total cost of $774,000. The overall goal was to prepare students to successfully enter the world of work. Among the specific goals were self-awareness, career preparation, attitude development, economic awareness, and consumer competencies. Project CERES was a three year research and development effort designed to infuse career education into the existing elementary and secondary curriculum.

The Ceres school district is in Stanislaus County, California near the city of Modesto. Stanislaus County is in the San Joaquin Valley, a major agricultural area of the state. The Ceres Unified School District has a student population of 4,200 in grades K-12. There are five elementary schools, one junior high, and one high school. Family income generally is modest. Approximately twelve percent of the county population is black or Mexican American (Baker and Lish, 1978).

The project was staffed within the regular school framework and did not require changes in the regular staff assignments.

It operated within the context of the regular classroom. Implementation included inservice training for the personnel involved, a guidance component, a media center, community involvement, and the development of instructional materials.

The evaluation of the program was conducted by the project staff with the assistance of an outside research specialist. The staff received consultation from the California State Department of Education. The evaluation focused on attainment of ten specific goals formulated at the outset of the project. The *t*-test was used to compare pre- and post-test results on the Primary Career Objective Test (K-3) and the Intermediate Career Objective Test (4-6). Baker (1978) of the American Institutes of Research reported the following results:

> The mean post-test scores of the treatment groups are significantly higher than the mean post-test scores of the control group. Note that the control group mean pre-test score at the primary level was superior to that of the treatment group; this situation was reversed on the post-test, with the treatment group scores exceeding those of the control group by a wide margin....The treatment group at the intermediate level was superior to its control group on the pre-test. Thus, one cannot be certain that the post-test differences at the intermediate level are in fact attributable to the treatment. At the primary level, of course, the post-test differences can reasonably be attributed to the treatment, since the treatment and control groups were not significantly different on the pre-test. (p. 8)

Mathematics was utilized at the secondary level as a vehicle to accomplish the goals of the program. In addition, it was reported that the project included one hundred Learning Achievement Packages. As an illustration of the planned progress of students through the career education curriculum, Baker and Lish (1978) wrote:

> In the K-6 grades the curriculum includes career simulation games, learning center activities, study trips, and presentations by community resource persons...all participating teachers are aware of the student goals and objectives...and it is expected that the impact of the experiences provided will lead to the achievement of objectives. (p. 11)

They pointed out that in the ninth grade, career education emphasis was placed upon job application skills. In the tenth grade, a portion of each student's mathematics, science, language arts, and social studies classes was directed to teaching how the content and skills of each discipline were related to individual career choices.

In the final report of the project, it was noted that a resource book, the *Ceres Compendium of Career Education Infusion Activities*, was developed and made available for national distribution. The Compendium provided teachers with many examples of career education classroom activities for most courses taught in mathematics.

Baker (1978) also indicated that the evaluation provided reasonable evidence that Project CERES produced educationally meaningful results. The level of statistical significance obtained indicated that the results were not a result of chance. The gains of the treatment group were large, exceeding those of the control group by a range of over one standard deviation at the primary level to one-third of a standard deviation among lower socioeconomic intermediate students. Moreover, the gains were in areas important to career education.

PROJECT EDUCATIONAL PROGRESS
IN CAREERS: EPIC
(Fort Lauderdale, Florida)

This project was developed during 1974-1976 under the auspices of "The Council of 100" with funds from the Vocational Education Act. The project was a statewide mechanism for obtaining the involvement of persons from business and industry. As stated by Lipe and Justiz (1978)

in their report on the project, the objectives of EPIC were:

> To incorporate employers' and other community leaders' concerns into the concept of career education; to collaboratively develop an instrument to assess whether career education has been *implemented* according to that concept and to develop reliable and valid measures to assess student *outcomes* for those students who have been involved in career education as defined by the concept developed in objective 1. (p. 1)

Six specific related goals were: to give students their first broad exposure to the world of business; to expose them to the world of occupations; to expose educators and administrators to career and economic elements; to give school districts a valid and reliable method for assessing progress in career education; to develop valid data gathering procedures; and to develop a method for involving the broad community in evaluating career education (Lipe and Justiz, 1978, p. 4).

According to Lipe of the American Institutes of Research, Project EPIC was organized by "The Committee of 100" into a non-profit corporation called EPIC. The first task the corporation carried out was to call together a statewide evaluation committee consisting of fifty-six leaders of the working community from across the state. The group identified ten components as central to the concept of career education. These components were identified from several sources, including the USOE Comprehensive Career Education Model prepared at The Ohio State University. With the assistance of the Florida State Department of Education, EPIC developed instruments to measure the variables involved in the project (Lipe, 1978b).

AIR and EPIC have claimed that this activity resulted in the attainment of significantly greater levels of desired outcomes among students who attended schools where EPIC-defined career education approaches were implemented.

Staffing needs for implementation at the local level were not determinable from information available nor was per pupil cost for implementation at the local level. Neither AIR nor the final report of this project indicated what subjects were involved in carrying the concept to the students. Therefore, it is not known to what extent mathematics was utilized as a vehicle. However, according to Lipe (1978b):

> The statewide effort in Florida successfully brought together employers, educators, and other community representatives in a unique approach to "Education and Work Councils." The effort mobilized a large group of leaders from varied backgrounds and directed their collective energies toward the development of process and outcome evaluation instruments. The approach provided for balanced influence from several potentially opposing forces including state and local business community leaders, educators and lay-persons. (p. 8)

EDUCATIONAL PREPARATION FOR
INVOLVEMENT IN CAREERS:
PROJECT EPIC
(Louisville, Kentucky)

This project, funded by the Office of Career Education, was developed from 1975 to 1977. Project EPIC was an infusion program specially designed to prepare low-income students for life's roles. It covered grades 9-12.

According to Kaplan and Preli, (1978) in the final report to the Office of Career Education, the project had five goals:

1. To provide low-income students with career education experiences that will enable them to increase --

   self-awareness;

   basic academic/vocational skills;

   awareness of work values;

awareness of knowledge about work;

career decision-making skills;

good work habits;

job-seeking skills;

placement;

awareness of the means for continued education.

2. To provide the school staff with necessary education knowledge, skills, and understanding that will enable them to --

   implement the education program via infusion techniques;

   involve the business-labor-professional community in the project;

   participate in a management information system designed to help project staff implement an operational plan to achieve project objectives.

3. To provide the business-labor-professional community with the necessary career education knowledge and understanding that will enable community members to participate in the project and to provide feedback.

4. To disseminate the project's materials and techniques on a local, regional, and national basis.

5. To provide effective and efficient management of the career education project through the use of an information-based decision-making model. (p. 4)

Jefferson County, where Louisville is located, contains both urban and suburban communities and has a population of approxiamtely 733,000, about eighty-five percent white and fifteen percent minorities. The minority population is primarily black. A majority of the students attending the schools of Jefferson County were from middle-income families, with about half living in urban areas and half

in the suburbs. The schools involved in the project had a total enrollment of 2,788 with an average class size of thirty.

According to the American Institutes of Research submission to the Joint Dissemination and Review Panel, the key staff person was a staff trainer who was responsible for the infusion process, classroom teacher training, and coordinating community involvement. The professional staff was one project coordinator and three staff trainers. Staff development was carried out basically through a three day workshop at the beginning of the school year.

It was noted in the same submission to JDRP that infusion activities were carried out in courses such as English, social studies, and home economics. Mathematics was not specifically mentioned; hence, it can be inferred that mathematics did not play a significant role in the infusion process.

Kaplan (1978b), in her submission to JDRP, reported the following:

> Educational significance of these results can be judged on the importance of Project EPIC's objectives; the fact that success in achieving these objectives was demonstrated over a one year period; the reasonable cost of implementing the program; and the relationship of academic achievement and increased self-esteem to later success in careers. Project EPIC's infusion approach entails a minimum disruption of ongoing educational programs.
>
> In summary, these effects are of non-trivial magnitude in content areas generally accepted as important (reading, mathematics, and self-esteem) and can be achieved at a reasonable cost. (p. 9)

PROJECT EQUALITY
(Seattle, Washington)

This project was funded from 1973 to 1977 by ESEA Title III and ESEA Title IVc monies in the Highline Public Schools for the primary purpose of reducing sex-role stereotyping in students at the K-6 grade levels. It was intended that this goal be carried out through occupation simulation packets that had the following characteristics:

- The packets provided content material which could expand students' perceptions of occupations open to females and to males.
- The packets fit within the context of subjects the teacher was already expected to cover.
- The packets were self-contained.
- The packets were easily adapted to different classroom settings.
- The packets did not require any additional teaching or support staff members for implementation.

Hamilton and Ross (1978) noted in their final report on the project to the Office of Career Education that the Highline District can be characterized as predominately middle-class, with ninety percent or higher white population.

The professional staff of the project from 1973 to 1978 consisted of a project director and an information facilitator. The staff members trained district staffs to implement the materials. The nature of this training was not reported specifically; however, it apparently consisted of an initial one and one-half day training session and two one-half day follow-up sessions.

Although the project did not directly utilize a mathematics course in its implementation, it relied heavily upon mathematics related materials. For example, the occupations included stock clerk, carpenter, and plumber. The activities performed by the children in the study required the use of mathematics to a very large degree.

In addition, the project reported use of a measuring unit in grades 5-6 that employed mathematics concepts while stressing measuring skills found in different occupations. This unit required that students pass through six different work stations using measuring skills. One station was an employment counselor where students used a stopwatch. At a different station, a student became a shoe salesclerk and used a measuring device to find the correct size of shoe needed. Another station involved a person working in a grocery store, both as a checker and manager.

The stations were named tailor/seamstress, employment counselor, carpenter, grocery store manager, shoe salesperson, and advertising layout person. Each station required the use of mathematics to carry out the measuring task.

The report by Kaplan and Preli (1978) on the project included this activity:

> A math teacher assigned her students independent research projects. In a consumer math course, students simulated a car salesperson's task of figuring out the interest to be paid on a car loan. An algebra student brought in a police officer to be interviewed. The officer discussed the formula used to compute how fast a car was going at the time of an accident by measuring skid marks and plugging them into a formula that yields an unknown value (i.e., miles per hour) when other values (e.g., length of skid marks) are known. (p. 14)

In this project, students on field trips visited workers in real-life settings and observed them as they carried out their responsibilities. An internship of varying lengths also was available to juniors and seniors in high school. The internship was a non-paid experience in a career field of the student's choice. The terms of the experience were defined for the students and employers by means of a contract. A pre-internship orientation was provided for students as well as a follow-up analysis with the employers.

The study designed to assess the impact of this program was conducted with K-6 students. It was structured to provide pre- and post-test measures of performance on treatment and control students for each packet of materials. McBain and McKay (1978) reported the following:

> Six of the seven materials produced gains of over one standard deviation at one or more grade levels. Eighteen out of twenty gains were greater than one-third of a standard deviation. Gains of one-third standard deviation or more were obtained at every grade level that was tested.... The evidence given above demonstrates that these materials are highly effective. (p. 10)

MATCHING ATTITUDES AND TALENTS TO CAREER HORIZONS: PROJECT MATCH (Ontario, California)

This project was under active development from 1974 to 1978 in the Ontario-Montclair School District. It was funded throughout those years by an ESEA Title IV-C grant.

The goals of the project were to infuse career education units into the regular curriculum (K to 8) in order to assist students in the attainment of "terminal performance objectives" in ten areas: career awareness, self-awareness, attitudes, educational awareness, economic awareness, consumer competencies, career orientation, career exploration, career planning and decision making, and civic responsibility.

The school district is approximately forty miles east of Los Angeles. The economy of the area is based on both agriculture and industry. The school district includes a wide range of socioeconomic and ethnic groups. There are approximately sixty percent white, thirty-four percent Spanish American and five percent black students among the school population.

With regard to staffing, Baker (1978b) of the American Institutes of Research reported the following:

Project MATCH operated within the framework of existing school staffing arrangements. Because it was curriculum oriented, it did not require changes in regular staff assignments, duties, or procedures. Its professional staff consisted of the project specialist (director), who worked with the local school administrators and teachers in developing, implementing, and evaluating the project curriculum.

Staff development consisted of several components, including summer writing workshops, school visitations, career education-community seminars, and staff meetings. It was estimated that for this program to be replicated in other school districts, a minimum of three inservice days would be needed.

Mathematics was one of the areas specifically mentioned as a vehicle to carry the program to the students. For example, a unit on checks and checking accounts was cited by the project director in his final report. It was the intent of the program to integrate career education units into the curriculum so that it would become an integral part of the instruction.

In addition, it was reported that career education infusion was done in several ways, including eighty units of concepts, performance objectives, and what was termed Experimental Taxonomy Career Education Units. A sample unit in mathematics was Checks and Checking Accounts. The unit was infused into grades 5-8 by means of a program called Simutown, a simulation program in economics, consumerism, civic operation, and citizen responsibility. Its major simulation activities were in banking, business operations, and government. It was reported that this program was strong in the content areas of mathematics, language arts, and social studies (Baker and Steinaker, 1978).

Baker and Steinaker (1978), in their final report of the project,indicated that the project can be implemented with relatively little cost. The major costs were for materials, inservice training, consultation, and possibly the salary of a part-time coordinator or liaison person.

According to Baker's report (1978b) to the Joint Dissemination and Review Panel, the project served about 1,824

students per year at a total cost of $324,000. The per pupil cost of implementation was approximately $44.50. In the same report, Baker stated:

> Mean post-test differences between treatment and control classes were analyzed using the *t*-test for independent groups....The treatment classes consistently out-performed the control classes by a wide margin on the post-tests. On all four tests, group differences were highly significant.... The nature of the evaluation design allows one to be confident that the gains observed in the treatment classes are in fact attributable to Project MATCH....In general, the evaluation provides convincing evidence that Project MATCH produced educationally significant results. (pp. 8-9)

SUMMARY

It is evident that a large majority of these programs began their implementation process in the early grades. The majority started in the primary grades and many activities began in kindergarten. Most programs carried the concept through to high school graduation. While different aspects of career education are stressed at different levels in the curriculum, almost all programs emphasized the following somewhere in the span from K to 12:

- self-awareness
- attitudes
- decision-making
- consumerism
- work habits
- job seeking skills
- career planning

The cost of implementing a program varied significantly. Of the ten projects noted in this paper, the cost variation for implementation ranged from $76 to $.76 per pupil per year. Therefore, career education is within the financial reach of every school district in the country. The major difference in the cost of implementation was the method of staffing used. Those districts that had the lowest costs implemented career education within their own staffing framework and did not require any special personnel or rearrangement of personnel. Those with the highest costs had the most intricate staffing arrangements. Only two of the ten programs were able to carry out implementation without special personnel. The average cost of implementing the programs was $27.43 per pupil per year.

On the basis of these projects, it appears that infusion is a superior method to "add-on." It also is apparent that it is far better to use several subject areas for implementation rather than a single subject. Furthermore, all the projects made extensive use of the broad community, parents, business, labor, industry, and the professions. Career education obviously can be implemented in schools with varied racial and ethnic mixes.

Two of the major considerations for implementing career education at any level are inservice training and instructional materials. Based upon the experience of those involved in these ten projects, it is clear that inservice training must take place prior to any attempt at implementation and must continue through all stages of the process. It also is evident that the bulk of the materials must be prepared locally in order to fit the specific needs of the population of students being served.

The subject areas utilized most as vehicles for career education are English, social studies, vocational education, and mathematics. Eight of the programs identified by the American Institutes for Research specifically stated that mathematics was a major subject area used for implementation of career education. Many reports noted that the learning of mathematics was enhanced by career education. In short, mathematics has been a significant vehicle in career education and, assuredly, will continue to be in the future.

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